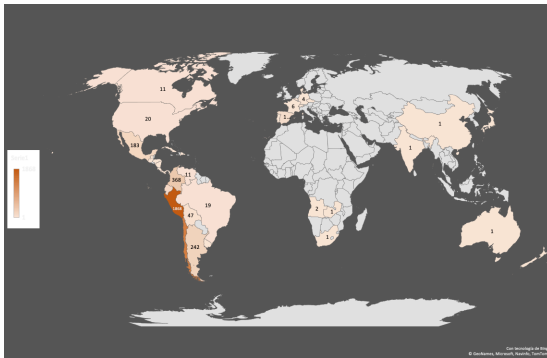


Clean Energy Opportunities in Latin American Mining



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“el Dorado” for clean energy mining in mining

- CONTENTS:

- Market Trends
- Opportunities
 - Chile
 - Argentina
 - Colombia
 - Ecuador
 - Mexico
- Boston Consulting Group Matrix

- LatAm renewables in mining segment:

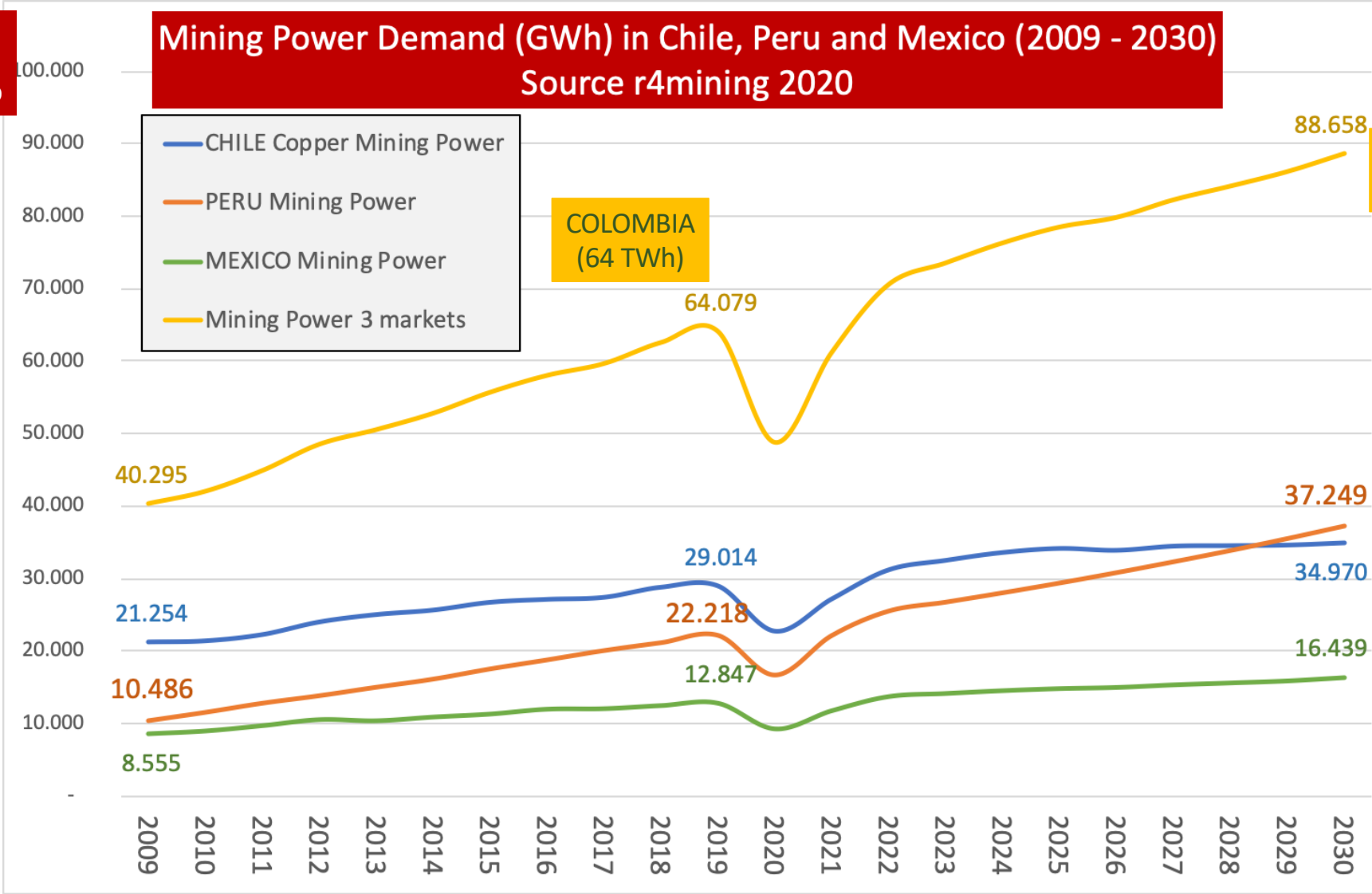
- achieves the 76% of the global share
- It is a ongrid mining market but 12% is off-grid
 - 5% Typical off grid
 - 7% embedded off grid in on grid mines



ELECTRIC
TRANSPORT
NOT INCLUDED

NEW
ZEALAND
(40 TWh)

Electricity
domestic
Consumption
(TWh) 2019



COLOMBIA
(64 TWh)

BELGIUM
(83 TWh)

PERU
will surpass
CHILE

Opportunities in Chile

- BHP, Anglo American- Glencore (Collahuasi), Antofagasta Minerals Corporate PPAs
 - By 2022: 14 TWh/yr of renewables in mining
 - By 2025: close to 20 TWh/yr
- Cerro Dominador CSP Tower Plant
- New kids on the Block
 - Bill Gates fund invest in reducing water for lithium mines
- Opportunities for ion lithium Batteries
 - For grid quality control and for peak shaving reductions in mining mills
- Promotion of Hydrogen in mines
- Opportunities (self consumption)
 - Diesel displacement in mines
 - Embedded off grid in on-grid mines
 - Mining camps (construction, operation, 2,000 – 7,000 beds)
 - Solar PV, solar thermal (hydrometallurgy)
 - SME off grid mines
 - Floating solar for mining ponds
 - Desalination and pumping water
 - Electric stations, buses, light Evs ...



Opportunities in Perú

- 2019: the beginning of new renewable for mining era
 - PV and wind energy can beat gas and hydro
 - Cerro Verde 200 MWp solar PV (copper)
 - Minera Buenaventura
 - about 40 MW solar & batteries project portfolio
- New gold mines solar PV off-grid projects
 - 4,000 to 5,000 m altitude
- Goldfields (floating solar)
- Newmont
 - Closing mine for solar PV, wind and mini-hydro
 - Studying for future mine expansions
- Currently five mines with pilot projects for EVS BUS

Scoops and electric drilling rigs in underground mining



Solar PV + batteries in mining camps and new gold mining projects (San Gabriel, Corcohuayco, etc)



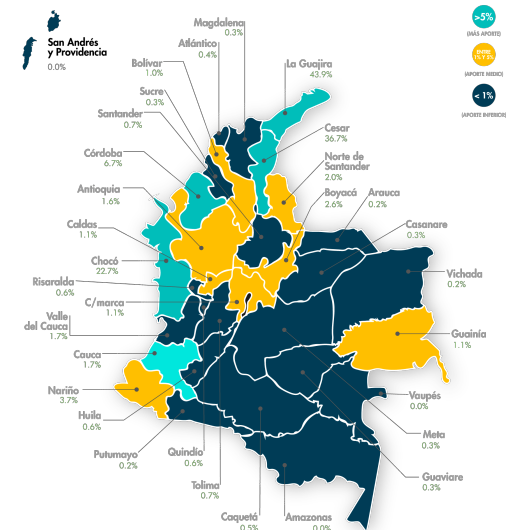
Mass transportation for miners with electric buses



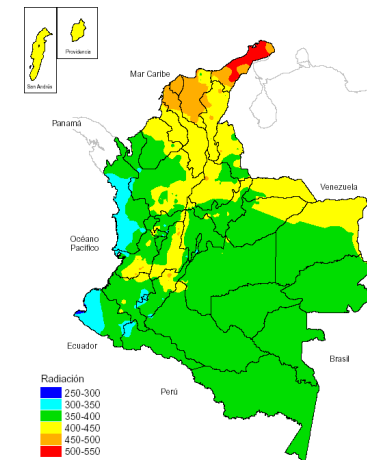
Opportunities in Colombia

- Country begins with solar PV and wind installations in the north
 - Due to higher power costs
- Best solar PV & Wind resources for hybrid networks in the north
 - However needs for ion-lithium batteries to control passing clouds
- Great potential for off-grid (bad grid) gold mines (central north)
- Low risk legal framework for investment
- Grid competitor: Hydro lobby

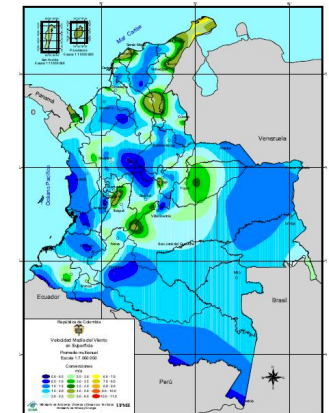
MINING REGIONS



SOLAR RESOURCES



WIND RESOURCES



Opportunities in Ecuador

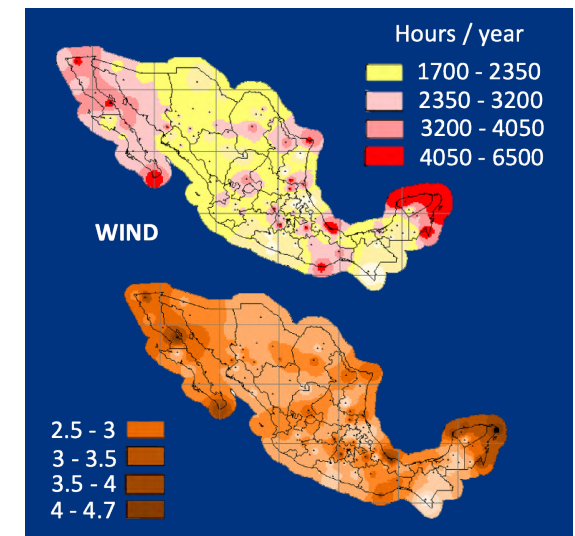
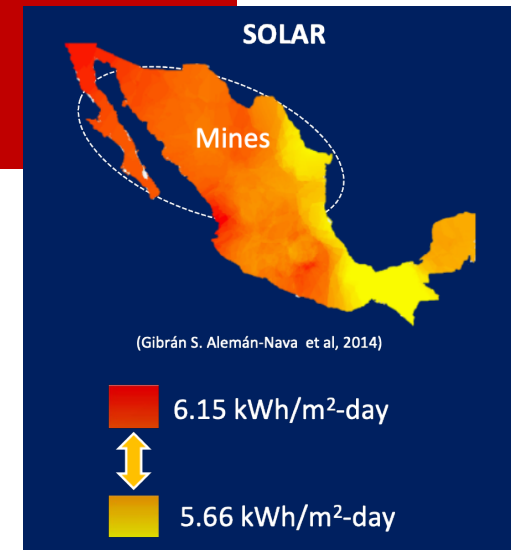
- Young mining market
 - Dominated by exploration mining companies
- Great mining projects are starting in Ecuador
 - Last year first copper concentrates exports
- Exploration and small gold mines excellent opportunity for off-grid solutions
- Bad image and difficult social licence achievement
- Ecuador is a future promise but not a big player

Provincias Concesiones en Minería Industrial

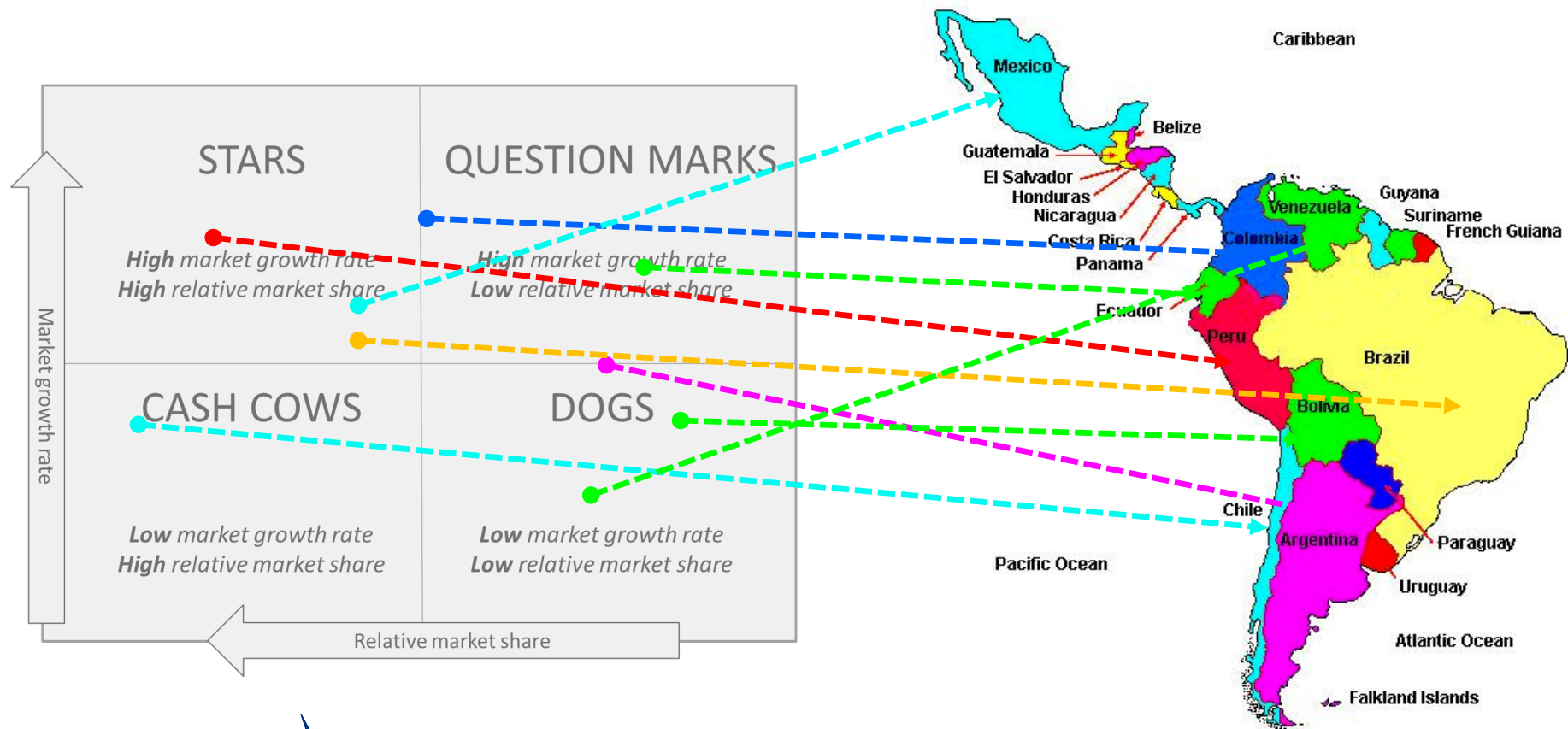


Opportunities in Mexico

- Mining electricity consumption equals 95% the total power consumption of Mexico D. F.
- Government commitment to renewable energy transition but complex grid topology
- Huge solar, wind and geothermal resources in mining regions (figures)
- *Grupo Mexico* and *Peñoles* with wind plants and currently working on solar PV projects
- 5 - 10% Off-grid Market
- Low cost grid electricity
 - But Increasing cost of energy by 30%
- Opportunities in “other mines”:
 - Industrial minerals and concrete industry



BCG matrix apply to Clean Energy for Mining in LatAm



Thank you, keep safe!!

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